Supplementary written evidence submitted by Alstom

Introduction

1. The following is a supplement to our response to the Transport Select Committee's inquiry into Trains Fit for the Future (TFF0024). It is submitted by Alstom UK & Ireland.

2. We note your evidence session held on the 11th November 2020 and we would welcome the opportunity to present to the committee at any further evidence sessions that the committee might hold, particularly to discuss our major advancement in the development of hydrogen train technology that could see hydrogen trains running on regional routes as early as 2024. We are also happy to provide any further information that may assist with this inquiry, and would be delighted to welcome committee members to our factory in Widnes where the UK's first passenger-ready hydrogen train is currently being developed.

About Alstom

3. Since our last submission, in February 2020, Alstom has announced that we have come to an agreement to acquire Bombardier Transportation. Upon completion, Alstom will become the largest rail manufacturer in the UK: significantly increasing its scale and industrial footprint and playing an even more pivotal role in delivering sustainable transport systems designed and built in the North of England – which will be crucial for the Prime Minister's levelling up agenda and plans for a green industrial revolution. As part of this, Alstom will also be taking over one of the UK's oldest manufacturing hubs in Derby and we have ambitious plans to create a global centre of excellence there.

4. Alstom's heritage in the UK goes back over a century and its plan is the only 'shovel-ready' hydrogen train programme. Alstom is ready to move fast to help the Government meet its objectives.

An update on developments since our first submission

5. Since our first submission, the Covid pandemic has brought unforeseen and unprecedented changes to our way of life and our concept of the future. Glimmers of hope in terms of viable vaccines are leading to expectations of a return to "normality" but whatever the future holds, there is likely to be a "new normal".

6. New normal may involve different travel patterns and different working patterns but it seems unlikely that the overall appetite amongst people to travel and to move around will diminish, certainly if the frustrations about lockdowns are to be believed. Yet rail remains the backbone of our public transport network. Trains fit for the future will have to appeal to those wishing to travel and still meet the objectives that we referred to last year, namely providing safe, accessible, inclusive, reliable and attractive travel options to all those who wish to travel, promoting modal shift away from cars of whatever kind and helping us to confront the crisis that is not receding, the climate change crisis – particularly if we are to meet the Government's own ambitions to decarbonise rail transport by 2040.

7. Alstom is committed to achieving full decarbonisation of the UK's rail network through a rolling programme of electrification and battery-operated trains, as well as the rapid deployment of hydrogen train technology. In the last year the environmental credentials of rail have improved, 250km more track was electrified (moving the network to a 38% rate of electrification) and newer, more efficient trains have continued to be brought into service. Despite this achievement, over 60% of the network remains unelectrified and is operated by over 1,000 aging diesel trains. For this reason, Alstom's continued work on hydrogen trains remains critical.

8. Other countries are pressing ahead with national hydrogen strategies and there is a risk of the UK falling behind. Technology cycles are being compressed and innovation is happening faster than ever before. In Germany, our Coradia iLints operated in full passenger service for over 180,000km over a 20 month period and since then have run successful trials in the Netherlands before entering passenger service in Austria. Two fleets of 14 and 27 trains have been ordered in Germany and will enter service in 2021 and 2022 respectively. Wherever they are deployed they demonstrate the viability of hydrogen trains to provide a suitable alternative to longer range diesel trains on non-electrified regional railways. As well as being environmentally friendly, hydrogen trains are also proven to be much smoother and quieter, with improved reliability, for passengers.

9. In light of this background, Alstom and Eversholt Rail have continued our development of the "Breeze" hydrogen train conversion that we highlighted in our first submission. The design work has continued and together this summer we have committed a further £1M of investment to the development programme in order to undertake a programme of 'Advance Works' to develop further the key areas of the train design, progress the safety and approvals activities associated with fleet introduction, and thereby maintain programme momentum in anticipation of receiving the first fleet order. As part of this process, the trains have been registered as Class 600 Breeze Hydrogen Multiple Units (HMUs), the first in the "6xx" series of trains, a class for future alternative energy trains.

10. The reason we have carried on with this work, and continued to invest without any external support, is because of our belief that this technology will be crucial to achieving the objectives that have been set for the railways of the future that trains fit for the future will operate on. The benefits of hydrogen should be brought forward to the UK network as soon as possible which is why we have moved quickly to ensure our programme is "shovel ready". We stand ready to deliver the UK's first hydrogen train fleet as soon as we have the green light from Government – creating hundreds of jobs at our manufacturing facility in Widnes, plus support teams wherever fleets are deployed, with more to follow with additional fleets.

11. We have worked closely with a number of stakeholders, including BEIS and DfT, train operators, hydrogen suppliers and local authorities to advance the first potential hydrogen fleet deployment. This deployment would initiate the introduction of hydrogen onto the UK rail network, validating key designs and securing operating approvals, by putting the technology into long term passenger operation. This would be a first step towards a UK-wide roll-out of fleets to displace life expired diesels. It would start to accrue carbon savings from day one of operation (in 2024 if we act soon) and help to offset the emissions on routes that will either never see electrification or are not planned to be electrified for decades to come.

12. The UK has a real opportunity to lead the world in the development of hydrogen train technology: creating thousands of green jobs and reducing harmful emissions. If we act swiftly, Alstom will play a key role in establishing the UK as a technology led, industrial centre for the supply of hydrogen equipment. The demand for equipment fitted to trains (and other heavy vehicles in due course) would allow the supply chain in the UK to grow and set down roots meeting the domestic demand. Based on that demand, they could reach out to export to meet demand around the world. Here in the UK, hundreds of hydrogen trains would be required to replace just half of the existing UK regional diesel fleet consisting of around 2,400 carriages typically formed into around one thousand one, two and three car trains. In Europe, around a further 6,000 diesel powered trains will require replacement, and globally many more, generating potential markets measured in billions of pounds.

13. In light of these developments, the Government should initiate a ten-year hydrogen train programme to deploy 300 to 400 hydrogen trains on the network with more to follow. A 300–400 train deployment, including supporting infrastructure would cost £1bn–£2bn but this is a financed solution with no significant initial government capital cost. Trains can be leased through the familiar system in place. The fuelling infrastructure can then be similarly financed. Such a commitment would link to the forthcoming UK Hydrogen Strategy and focus the sector on a green recovery. Hydrogen provides a ready source of skilled, green jobs, the majority of which will be in the North of England in locations including Derby, Widnes and Manchester. This will support the Prime Minister's plans for a green industrial revolution.

14. As has been seen before, Capex works well to incentivise R&D, but when applied to projects without additional OpEx support, it encourages the building of white elephants. It is better that government encourages private capital investment in the trains and infrastructure through OpEx subsidy in the form of market support mechanisms – in a similar fashion to that seen in the renewables energy sector where incentives such as ROCs (Renewables Obligations Certificates) to build capacity followed by CfDs (Contracts for Difference) have been used to encourage cost reduction. This is a more effective use of public funds and would help to grow what must ultimately become a privately funded industry, at least to a similar extent to which regional railways achieve cost effectiveness with diesel traction.

15. Our original submission highlighted our concerns around the process of "innovation" in the rail sector. We highlighted the issues around uncertainty and the need for clear industry structuring and leadership, ideally based on the, at the time, unseen recommendations of the Williams Review. These concerns unfortunately remain as the Williams Review recommendations are still yet to be published and the future organsiation of the rail sector remains uncertain. It is crucial that, in striving to define trains fit for the future, we understand what the railway will be and how it will be organised. Who will specify and buy those trains?

Today, this is unclear. Whilst we note the potential Direct Awards proposed for the rail operators, we would urge further progress in this area as soon as possible in order to allow manufacturers to focus on the potential market and plan products accordingly.

16. One other area of progress since our last submission has been the release of Network Rail's Traction Decarbonisation Network Strategy Interim Business Case (the "TDNS"). We welcome and support the ambition expressed in this document, and are commited to working closely with industry as the UK moves towards a low carbon future. We do have some concerns about its perceived direction and would like to see it go further and be even more ambitious when it comes to alternative traction technologies like hydrogen. These concerns are as follows:

    a. The TDNS sets out to forecast, based on the technology base of today, the end state for the decarbonised UK rail network. Whilst we fully accept the risks of basing forecasts on assumed technological advances, we would be concerned that a strategy set today, based on technologies known today, extending to beyond 2050 risks stifling any further innovation. It could be a mistake to focus on the current limitations of alternative technologies, rather than their future horizons.
    b. The emphasis of the TDNS is built on the extensive electrification of areas of the network currently not electrified. As a leading provider of electrification, Alstom fully supports an ambitious rolling programme of electrification but the proposed programmes of works to deliver this amount of electrification extends beyond 2050 and risks missing crucial deadlines for decarbonisation and net zero. With its emphasis on net zero 2050, it also seems to risk failing in the challenge set by the then Minister of State, Jo Johnson MP, who proposed the removal of all "pure diesel" trains by 2040.
    c. In parallel, in his Ten Point Green Plan for recovery, the Prime Minister has announced that the Government will bring forward the deadline for the end of sales of petrol and diesel powered road vehicles to 2030 (and 2035 for certain hybrids). It seems wrong to assume, against this ambitious backdrop, that passengers will believe, for long after they cannot buy diesel cars, that travelling on diesel powered trains, whether or not they are bi-mode or hybrid is acceptable.
    d. Although the TDNS does recognise a limited role for "transition technologies" (for example using hydrogen trains during the period until electrification) as drafted there is a risk that the strategy will, instead, be used as justification to do nothing today because electrification will come "one day". Pushing back activity will build a huge and ultimately undeliverable backlog as we approach deadlines for net zero.
    e. Is it possible to give a commitment to a programme of this cost and duration spanning multiple parliaments and decades of implementation with sufficient certainty? Sadly, the industry has seen many ambitious electrification plans cut back but in this case. Should that happen again, we risk not having a viable alternative solution that can be deployed in time to meet the legislated targets. We also fail to create a need for research and development to address the challenges of, for example, replacing diesel freight locomotives with self-powered alternatives.

17. In relation to the above points regarding the TDNS and our reservations about the consideration of future technologies (cited in point 16(a) above) we noted with interest the question raised by Lillian Greenwood MP during your evidence session of the 11th November. She asked the following: ""We have heard, and we know, that at the moment hydrogen cannot power trains to 125 mph. It cannot haul freight. It is not so good for intensively used lines where you need fast acceleration. Could hydrogen ever do those things? Is it about economics or about physics? What is the answer?" In response we would make the following points:

    a. The laws of physics have a key role to play in the performance of any self-powered vehicle. The harder you accelerate, the faster you travel, the greater the weight you seek to move, the more energy you require. These laws apply equally to diesel as they do to hydrogen or battery powered vehicles.
    b. The UK is almost unique in the use of diesel trains at speeds in excess of 100mph due to the increasing inefficiency of doing so. If you consume more fuel, you must carry more fuel, the more fuel you carry, the greater the weight of the train and hence the more fuel you need to power it. Energy required increases exponentially in relation to the speed of the vehicle and so you have ever diminishing benefits from the rapidly increasing volume and weight of fuel carried.
    c. What this means is that hydrogen trains could travel at 125mph, or more. They could accelerate as fast as any other electric train (and certainly faster than diesels) and they could haul freight but

they would need to carry more hydrogen on board, or have a shorter range and be refuelled more often than is considered reasonable in commercial operation.

d. It is for this reason that we would recommend route by route evaluation of the most suitable traction technology as has been made by the TDNS, but crucially it should be based on the develooment state and economics of technologies available at the time each route is to be addressed, not just as they are today.

e. Current hydrogen trains are designed to operate using hydrogen stored at 350bar pressure (350 times atmospheric pressure as adopted for commercial vehicle applications such as buses and HGVs to date). This means that to carry the same energy as diesel they require eight times more space for the fuel tanks. This is acceptable for regional trains giving sufficient range and performance to replace diesel multiple units, operating at up to 100mph against less demanding timetables – the Coradia iLint has demonstrated this.

f. Because of its greater constraints on space, the automotive sector uses storage at 700bar pressure which gives a greater energy density (not quite double due to some losses but not far off). As development in this sector progresses, the standardisation of the storage and refuelling at this pressure may become suitable for rail applications – some HGV manufacturers are starting to work in this field. This could benefit the range and capacity of regional trains, and could increase the viability of freight applications with higher power fuel cells. Other forms of hydrogen storage are also under development as bulk storage is an issue for all transport modes. In the rail sector, this development work is yet to be done, however, and will likely only take place if there is a perceived or expected market for it.

g. Economics is, of course, a factor as well. Research and development has a cost associated with it which manufacturers need to recover through future sales of the product. This is why, today, alternative energy trains cost more than existing diesels, supported as they are by existing infrastructure and know-how. These prices reduce with volume and overall total costs of ownership converge over time. For high speed, high frequency services, the business case for electrification is compelling, but in other areas there is no reason not to expect technical advancement as hydrogen trains start to roll out and the market is established to form a basis for further development and competition.

18. In conclusion, it is our expectation that trains fit for the future will be electric trains powered from overhead wires, batteries or hydrogen as appropriate to each route. We fully support an ambitious rolling programme of electrification, but expect it will be deployed to a less ambitious extent than forecast in the TDNS and that passenger service deployment of hydrogen in particular will be significantly greater than forecast. These trains will all be clean, safe and efficient means of transport developed to attract passengers and serve their needs in a manner that almost passes unnoticed and unquestioned. We are ready and able to provide such trains, powered by whatever means, and to support each with the relevant respective infrastructure that they require, starting now.

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